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Part IV

Consumer Product Safety Commission

Urea-Formaldehyde Foam Insulation; Request for Comment on Additional Data

CONSUMER PRODUCT SAFETY COMMISSION

16 CFR Part 1306

Urea-Formaldehyde Foam Insulation; Request for Comment on Additional Data

AGENCY: Consumer Product Safety Commission.

ACTION: Request for comment on additional data.

SUMMARY: On February 5, 1981 the Commission proposed a consumer product safety rule that would declare urea-formaldehyde (U.F.) foam insulation to be a banned hazardous product under section 8 of the Consumer Product Safety Act. The Commission specified that comments should be submitted by April 6, 1981. Since then, the Commission staff has obtained some additional technical data related to the U.F. foam insulation proposal. This notice summarizes and requests written comments on this additional data.

DATE: Written comments, limited to the additional data referred to in this notice, must be received in this Office of the Secretary no later than December 18, 1981.

ADDRESS: Comments should be mailed (preferably with five copies) to the Office of the Secretary, Consumer Product Safety Commission, Washington, D.C., 20207. Received comments may be seen in the Office of the Secretary, Third Floor, 1111 18th Street, NW., Washington, D.C., 20207. All material which the Commission has that is relevant to this proceeding may be seen in, or copies obtained from, the Office of the Secretary, Third Floor, 1111 18th Street, NW., Washington, D.C., 20207 (202) 634–7700.

FOR FURTHER INFORMATION CONTACT: Harry Cohen, Office of Program Management, Consumer Product Safety Commission, Washington, D.C., 20207; telephone (301) 492–6453.

SUPPLEMENTARY INFORMATION:

A. Background

On February 5, 1981, the Commission proposed a ban of urea-formaldehyde (U.F.) foam insulation under section 8 of the Consumer Product Safety Act (CPSA) (15 U.S.C. 2057). (See 46 FR 11188.) Based on information discussed in the proposal, the Commission preliminarily concluded that U.F. foam insulation presents an unreasonable risk of injury due to formaldehyde gas that is released from the product after it is installed. Formaldehyde gas released from U.F. foam insulation can cause illness from acute toxicity and can also cause an increased risk of cancer to consumers who are exposed to the gas. The Commission also preliminarily concluded that no feasible product standard, including labeling or information disclosure, would adequately protect the public from the risk of injury associated with U.F. foam insulation.

The proposed ban specified that written comments should be submitted on or before April 6, 1981. The Commission received over 270 comments in response to the proposed ban. Certain comments criticize the proposal and raise complex scientific and technical issues. In order to adequately respond to certain comments, the Commission by notice published in the **Federal Register** on October 6, 1981 (46 FR 49140), extended the time in which it must issue a final ban or withdraw the proposed ban until February 15, 1982. The Commission announced that it would publish the results of some additional technical work in the **Federal Register** for an additional public comment period.

Accordingly, the Commission is now publishing for public comment certain technical, health risk, and economic information gathered since the proposal was published. These data address some of the comments received on the proposed ban and supplement and update the data discussed in the proposal itself. Copies of the studies referred to below are available from the Commission's Office of the Secretary.

B. Formaldehyde Offgassing Studies at the Oak Ridge National Laboratory and at the CPSC Engineering Laboratory

Some of the public comments on the proposed ban criticized certain aspects of the Franklin Institute Research Laboratory (FIRL) study discussed in the proposal (FIRL, *Final Report,* Urea Formaldehyde Foam Insulation Study, F-C5316–01, January, 1981 [1]). In this research, panels simulating actual walls were foamed, and the results were used to predict concentrations of formaldehyde gas in homes insulated with U.F. foam insulation. Most of the criticisms of this study concerned its effort to measure formaldehyde gas concentrations in the test panels under dynamic flow conditions. Other comments criticized the use of static measurements to predict formaldehyde concentrations in an average size room with U.F. foam wall insulation. Other criticisms concerned the lack of data in the report on the release of formaldehyde once the insulation has been in place for a period of time.

In an effort to more fully address these areas, the Commission in June of 1981 contracted with the U.S. Department of Energy to conduct further testing at the Oak Ridge National Laboratory (ORNL) on nine of the original Franklin panels. The ORNL performed measurements on the simulated wall panels under both static conditions (simulating enclosures with low air exchange) and dynamic flow conditions (simulating a room with an air exchange rate of 0.73 air changes per hour and geometrical load factor of 0.5 m^2/m^3.[2] Based on the formaldehyde gas concentration in the test panel's air chamber, the geometrical dimensions of the room, and the air exchange rate, the ORNL study data allow predictions of room concentrations of formaldehyde generated in a house insulated with U.F. foam insulation. The formaldehyde gas concentration determined under dynamic flow conditions can be related to static measurements. Knowing this relationship, the formaldehyde gas concentration in an average size room can be predicted from static data. The ORNL study also calculates and measures the diffusion coefficient of formaldehyde gas through drywall.

The final report from ORNL (*An Evaluation of Formaldehyde Emission Potential from Urea-Formaldehyde Foam Insulation: Panel Measurements and Modeling,* ORNL/TM–7959, September, 1981) [E–18] reaches a number of conclusions. The study shows that U.F. foam insulation offgasses formaldehyde for long periods of time after initial foaming (16 months in the test panels), even though some of the panels were foamed under controlled conditions in accordance with manufacturers' recommended practices. The study also indicates that dynamic flow measurements simulating geometrical factors and air exchange rates comparable to those found in typical homes can yield formaldehyde concentrations significantly above typical background levels (i.e., the latter being less than 0.05 ppm). The mean concentration of formaldehyde released

[1] Record document E–5. In the proposal, the bibliography of relevant documents was listed by a letter prefix designating the general subject matter area addressed by the document, followed by the document number within that area. Thus, "E–5" is the fifth document listed under "Engineering Information." The additional documents referred to in this notice are designated accordingly and are listed in the bibliography at the end of this notice. An additional bibliography of documents relevant to this proceeding is on file in the Commission's Office of the Secretary.

[2] Load factor is defined as the ratio of the U.F. foamed wall surface area through which the formaldehyde gas migrates to the volume of the room.

from the U.F. foam for the nine panels tested under dynamic conditions was 0.13 ppm. The study also indicates that drywall is not a good barrier to the transport of formaldehyde gas. The report notes that drywall is sufficiently permeable to make diffusional transport a significant pathway for formaldehyde gas release into living spaces.

The ORNL study measured formaldehyde gas release rates from test panels foamed using manufacturers' recommended practices and specifications at approximately 25°C (75°F) and 50 percent relative humidity. In addition, the Commission's staff conducted a study at the Commission's Engineering Laboratory on formaldehyde emissions at different temperatures from certain original Franklin test panels (other than those shipped to ORNL.) Eight of the 51 panels tested at CPSC for formaldehyde release were tested not only at an ambient temperature of 23°C (F3.4°F), but also at 33°C (91.4°F) and 40°C (194°F). These 8 panels were "properly foamed" in that the foaming was done by installers recommended by members of the industry and manufacturers' recommended practices and specification were followed. Other panels were foamed with specified variations from manufacturers' instructions, and one panel was not foamed and served as a control. Also, the staff analysis of the formaldehyde emission from all of the foamed panels shows little difference in offgassing between properly and improperly foamed panels.

The results of the testing show that the static formaldehyde gas levels obtained at 23°C were increased by an average factor of 6 at 33°C and a factor of 13 at 40°C. See *Urea-Formaldehyde Foam Insulation: Static Measurements of Gaseous Formaldehyde at Ambient and Elevated Temperature Conditions*, Catherine Pressler, CPSC, October 1981 [E–20].

The ORNL also reviewed three theoretical models as well as the Commission's empirical model for predicting room air concentrations of formaldehyde released from U.F. foam insulation. All of the theoretical models require information on the source strength of the U.F. foam insulation as an input parameter. However, this type of information is not easily modeled since it is based on the ability of U.F. foam insulation to generate formaldehyde gas, which in turn is dependent on environmental factors such as temperature, humidity, and age of foam.

ORNL concluded "That the models are helpful in determining trends and relative importance of various parameters but require further refinements before they are used for detailed projections of room concentrations" [E–19].

C. Revised Risk Assessment

Based in part on the new information on formaldehyde levels in U.F. foam insulated residence projected from the ORNL study and on other new information discussed below, CPSC staff have performed a revised risk assessment predicting the risk of cancer to consumers resulting from the release of formaldehyde gas from U.F. foam insulation in their residences. (See "Revised Carcinogenic Risk Assessment for Urea-Formaldehyde Foam Insulation: Estimates of Cancer Risks Due to Inhalation of Formaldehyde Releases by UFFI," by Murray S. Cohn, CPSC, October, 1981, on file at the Office of the Secretary [C–42].)

The revised risk assessment uses the new information from ORNL and the Commission laboratory on the offgassing of formaldehyde foam insulation (up to 16 months after foaming of the panels as compared to the 5 months used in the original risk assessment). The revised risk assessment also used newer data from the Chemical Industry Institute for Toxicology (CIIT) study of cancer induction in test animals from formaldehyde gas [C–43]. The new data include the development of nasal cancer in three of the animals tested at the 5.6 ppm formaldehyde level. The revised assessment also incorporates data from noncomplaint U.F. foam insulated homes (homes in which there was no report of adverse health effects) [C–42, App. A] and non-U.F. foam insulated residences [C–42, App B]. The data available at the time of the original risk assessment [C–6] were from "complaint" homes (U.F. foam insulated residences reporting an adverse health effect). The revised assessment also uses more data points from complaint homes than did the original assessment [C–42, App. A]. Formaldehyde measurements used in the revised assessment are available for almost 9 years after foaming, rather than 7 years in the original assessment. The data from non-U.F. foam insulated homes in the revised assessment are used to subtract out a background level of formaldehyde in residences so that the risk due only to formaldehyde release from insulation can be estimated for all U.F. foam insulated homes.

Using the data from actual measurements in residences, the revised risk assessment estimates an upper value of risk of 89 cancers developing among the estimated population of 1.75 million individuals currently exposed in 500,000 U.F. foam insulated homes. This upper estimate of risk can also be expressed as follows: Any individual living in a home with U.F. foam insulation for 9 years after installation would, according to the assessment, have an additional risk of 51 in a million of developing cancer from the formaldehyde released by the insulation. Further, if 260,000 people are assumed to be exposed from new installations (assuming 75,000 installations of U.F. foam insulation each year in the future), then up to 13 additional cancers could result from each year of new installations. Given the uncertainty of the annual number of installations of U.F. foam insulation in the future, this risk may be expressed as 1.8 additional cases of cancer from every 10,000 residences insulated.

Using the Franklin Institute Research Laboratories, ORNL, and CPSC laboratory data predicting levels of formaldehyde in homes, the revised risk assessment projects an upper value of risk of 65 cancers developing among the estimated population of 1.75 million persons in U.F. foam insulated homes. This upper estimate of risk can also be expressed as follows: Any individual living in a home with U.F. foam insulation for 9 years after installation would have a 37 in a million additional risk of developing cancer from the formaldehyde released by the installation. Furthermore, if there are 75,000 new U.F. foam installations each year, up to 10 additional cancers could result (up to 1.3 from every 10,000 installations).

It should be noted that, as in the original risk assessment discussed in the proposal document, the upper estimates of risk in the revised assessment assume that formaldehyde is able to interact with other environmental carcinogens and carcinogenic processes within the human body in causing the development of cancer. The Commission's Directorate for Health Sciences considers the upper estimate of risk to be a more likely estimate than the lower estimate of risk since formaldehyde has the ability to interact with genetic material. The lower estimates of risk, which are derived from the assumption that formaldehyde does not interact with other carcinogens and carcinogenic processes, are essentially zero for both exposure sources indicated above. The Commission's Directorate for Health Sciences considers these lower estimates to be unlikely and contrary to the available biological evidence.

As in the original assessment, the revised assessment uses the

"multistage" model described in the proposal document to predict the risk of cancer. One difference in modeling technique between the two assessments, however, is that in the revised assessment, the exposure level-response curve is not asumed to be linear between the upper confidence limit at the lowest test dose and zero dose. Instead, the staff used the upper confidence limit generated by the multistage model computer program (Global 79), which determines, within the constraints of the data, the point at which the exposure level-response curve could become linear. This leads to a 2.4-fold reduction of the estimated upper value of risk in the revised assessment, compared to the original assessment, at any exposure level below approximately 1 ppm.

Data from the Thun et al. study (a study in New Jersey comparing the health effects reported for U.F. foam insulated homes versus control households) [A–41] which were used in the original risk assessment are not used in the revised assessment. The previous risk assessment required the use of the Thun et al. study because measurements were available at the time only from those U.F. foam insulated homes where health complaints had been made, and the Thun et al. study was used to estimate the percentage of all U.F. foam insulated homes in which complaints due to formaldehyde released from U.F. foam insulation could occur. The Thun et al. data are no longer needed because measurement data are now available for complaint, non-complaint, and non-U.F. foam insulated homes, and no significant differences were found in formaldehyde levels in complaint and non-complaint homes.

D. Economic Data

In November of 1980, the Commission's staff prepared a Preliminary Economic Assessment [EC–1] that was available to the public at the time the Commission published the proposed ban. Since that time, the Commission has received comments on the proposal, conducted a survey of insulation contractors, and gathered additional information from other sources. A Revised Preliminary Economic Assessment [EC–13] incorporating the additional information has been prepared and is available at the Office of the Secretary. The Commission is seeking public comment at this time on this additional economic information and on the Revised Preliminary Economic Assessment.

The Commission staff believes that the additional information may influence some of the assumptions and findings made in the earlier Preliminary Economic Assessment. The major areas that have changed as a result of the additional information are discussed below.

Telephone survey. After reviewing the comments from U.F. foam insulation installers on the proposal, Commission staff decided to conduct a telephone survey of insulation installers, with emphasis on current and former installers of U.F. foam insulation, to obtain more information on the economic status of these firms.

The main findings of the telephone survey are summarized below. (The complete report, "Report on a Survey of Insulation Contractors", October, 1981 [EC–11], as well as a summary report, "Summary of the Survey of Insulation Contractors", by Charles Smith, October 9, 1981 [EC–12], are available in the Commission's Office of the Secretary).

The telephone survey indicates that rapid growth of the U.S. foam insulation industry occurred from 1975 to 1977 when retrofit insulation activity of various kinds increased greatly and other insulation materials were not adequate to meet the rising demand. During this period, many new insulation contactors, some with little experience in the field, entered the market.

In its Preliminary Economic Assessment, the Commission staff analyzed estimates (from non-CPSC sources) of the number of installations and U.F. foam resin shipments. It concluded that the number of residential installations based on these estimates was between 404,000 and 666,000 for the years 1975 through 1980 and that the most reasonable estimates totaled 474,000 residential installations in those years.

Based on information gained in the survey of insulation contractors, the staff may reduce its estimate of the total number of residential U.F. foam installations. The previous estimates may not have considered non-residential installations of U.F. foam which, according to our survey, comprised about 10 percent of all installations. These usually larger installations may have consumed 20 percent or more of the U.F. foam resins used. The survey also provided information on the amount of U.F. foam resins used in an average residential application. Based on this information, the staff now estimates that residential installations of U.F. foam insulation from 1975 through 1980, the years in which nearly all installations were done, may have totalled less than 430,000. (This is a 9 percent reduction from the earlier approximation.)

In November, 1980, the staff estimated residential installations for 1980 to be about 75,000. That estimate was based on limited information provided earlier in the year. Information from the insulation contractor survey and elsewhere indicates that installations fell sharply in 1980. Residential installations for that year may have totaled only 25,000 to 30,000.

Based on the survey responses and other information provided by the industry, it appears that U.F. foam installations have declined further in 1981. Information provided by the National Insulation Certification Institute [EC–14] leads to an estimate that there may have been 5,000 or fewer residential installations of U.F. foam through August of 1981. Although sales reportedly have increased with each month, residential installations of U.S. foam insulation are not projected to be significantly greater than 8,000 to 10,000 for the year.

The survey also found that the average installed price of U.F. foam is in the range of 76¢ to 85¢ per square foot; drumsets of U.F. resin and foaming agent have an average wholesale price of slightly less than $250; the average wall area insulated in single-family homes is slightly less than 1,300 square feet, and an average of about 1.2 drumsets are required to insulate those residences. Also, based on information from the survey, the average price for a residential installation of U.F. foam insulation may be in the range of $933 to $1,127. The price paid by consumers for insulation with alternative materials may be approximately 10 percent less than if U.F. foam insulation is used.

Among other things, the survey indicated that U.F. foam was still a significant source of revenue for some firms in 1980. Several installers are still deriving substantial revenue from the product in 1981, although nearly all of these installers have other sources of revenue, and 81 percent of those surveyed install other retrofit wall insulation materials. For the U.F. foam installers surveyed, the average number of full-time employees is 8 to 10, and the average number of workers that install U.F. foam is slightly more than four. Average employment by those installers that were not surveyed may be less.

Sixty-two percent of the current U.F. foam installers surveyed stated that U.F. foam installations accounted for more than 50 percent of their revenues in 1980. For the firms surveyed, the average number of residential U.F. foam insulation installations in 1980 was about 140 per firm. This number is about 50 percent less than the 1979 figure for

these firms. In addition, most installers surveyed stated that the number of 1981 installations are at least 25 percent less than for the same period in 1980, and reported reductions of 80 percent and more were fairly common.

In addition, other information indicates that the number of active installers of U.F. foam insulation has now fallen to approximately 200 to 250 firms; the number of firms that are supplying U.F. foam resins is also much less than in previous years. Employment by installers and material suppliers has also fallen dramatically. To make up for lost revenues from declining U.F. foam insulation sales, current and former installers remaining in business generally have attempted to broaden their operations. Some have expanded into areas other than insulation, such as the installation of roofing, siding, and windows. However, most firms are operating at far lower revenues and numbers of employees than in previous years.

About 40 percent of the installers believe they will go out of business if the ban is issued in final form. Another 31 percent indicated they would have great difficulty in making up the lost revenues if U.F. foam insulation is banned.

Energy savings. In the Preliminary Economic Assessment, energy savings resulting from installation of U.F. foam were estimated. The revised assessment considers more current energy prices and projections of future prices. The survey of contractors provided useful information on the average wall area that is insulated. Commission staff previously assumed that 5 to 10 percent of residential installations involved narrow-cavity walls; the survey indicated that 10 to 15 percent of the walls of residences insulated were of this type.

The Preliminary Economic Assessment noted that the commercial development and availability of alternative insulating materials and methods, particularly for residences with narrow-cavity walls, may reduce the foregone energy savings in future years that may result from a ban.

Commission staff are now aware of claims for one possible alternative insulating material that is under development that may be foamed in place in narrow-cavity walls and some other applications in which U.F. foam is used [E–21]. The product is said to be an outgrowth of urethane technology. Its claimed R-value (a measure of insulating effectiveness) is slightly greater than that of U.F. foam, and it reportedly does not release formaldehyde gas. This product is being field-tested in 1981 by several companies. However, the Commission has not tested the product nor has it seen test data regarding offgassing from this product. At least one supplier has established wholesalers that distributed the materials to installers this year. Although not widely distributed this year, that supplier stated that commercial availability will be greater in 1982. If this product, or other types of insulation not subject to the ban, proves to be an acceptable substitute for U.F. foam in those applications of importance in the calculation of foregone energy savings, the Commission staff estimate of foregone energy savings, and, therefore, the estimated costs of a ban, in the proposal may be overstated.

Real estate values. In the Preliminary Economic Assessment, the Commission's staff noted that a ban could result in reductions in resale values of residences and other buildings that have been insulated with U.F. foam, although sufficient information to estimate the magnitude of the possible reductions was not available.

In the staff's view, the information that has come to their attention since the preliminary assessment was prepared still is inadequate to project the extent of any reductions in real estate values. Many factors complicate any attempt to predict the impact of a ban, including other economic factors such as greatly increased mortgage rates, the limited number of resales that could be compared with otherwise similar properties that have been sold, and the difficulty in assessing impacts on real estate values that may have already resulted from adverse publicity on U.F. foam. Also, many properties with U.F. foam insulation may not be resold until a number of years after a ban is in effect. Also, the effect of the passage of time on the perceived hazards of U.F. foam may be significant, but cannot be predicted with certainty.

Several comments on the proposed ban claimed that the reductions in real estate values following a ban would be equivalent to the costs of removal of U.F. foam and replacement with other types of insulation. Frequently these costs were said to average $10,000 to $20,000 per residence.

Based on a limited number of cases in which removal costs are known, those costs often have been less than $10,000, although in some cases they have totaled $20,000 or more. The Commission staff believes that $10,000 to $20,000 may overstate the average removal costs, particularly at the high end of that range. In any event, the staff cannot conclude that reductions in property values if U.F. foam insulation is banned would be equivalent to the costs of removal of U.F. foam. Massachusetts officials have advised the Commission that the state ban of U.F. foam insulation has not resulted in a systematic devaluation in property with the insulation. Commenters have not presented significant evidence from real estate market transactions to support claimed reductions in property values.

Conclusion

The Commission believes the public should have the opportunity to comment on the additional information described above and that such comment would be of benefit to the Commission in deciding the issues addressed by the new information. Accordingly, the Commission is seeking comment on the additional information and on the possible effects that such information may have on the findings made by the Commission in the proposal and on the ultimate decision of whether to issue a ban. Therefore, the Commission will accept comment on the new data referred to in this notice until December 18, 1981. However, the Commission wishes to point out that in requesting this comment, it has not adopted or approved the data and views stated in the new information or the staff's evaluations thereof.

(Secs. 8, 9, 30(d), Pub. L. 79–573, as amended, 90 Stat. 506 (15 U.S.C. 2057, 2058, 2079(d)))

Dated: November 16, 1981.

Sadye E. Dunn,

Secretary, Consumer Product Safety Commission.

Additional Bibliography (Also refer to Bibliography at the end of the proposal; 46 FR 11209, February 5, 1981.)

C–42 *Revised Carcinogenic Risk Assessment of Urea-Formaldehyde Foam Insulation: Estimates of Cancer Risk Due to Inhalation of Formaldehyde Released by UFFI,* Murray S. Cohn, CPSC, October 26, 1981.

C–43 *Progress Report on CIIT Formaldehyde Studies,* Docket No. 112D0, December 12, 1980, Chemical Industry Institute of Toxicology.

Acute Hazard Information

A–41 Thun, M.J.; Lakat, M.F.; and Altman, R. (1980). *N.J. Urea-Formaldehyde Foam Study,* New Jersey State Health Department; (unpublished).

Engineering Information

E–18 *An Evaluation of Formaldehyde Emission Potential from Urea-Formaldehyde Foam Insulation: Panel Measurements and Modeling,* Oak Ridge National Laboratory, September, 1981, ORNL/TM–7959.

E–19 *A Review of Proposed Models for Predicting Room Concentration of*

Formaldehyde from UFFI Emissions, A. R. Hawthrone, Oak Ridge National Laboratory, October 1981, W-7405-eng.-26.

E-20 *Urea-Formaldehyde Foam Insulation: Static Measurements Gaseous Formaldehyde at Ambient and Elevated Temperature Conditions*, Catherine Pressler, CPSC, October 1981.

E-21 Paper, *Low Density Foam for Retrofit Insulation*, C. John Galbraith, Michael J. Cartmell, and Reg Brown, Rubicon Chemicals, Inc., P.O. Box 751, Wilmington, Delaware 19897, January 22, 1981.

E-22 Memorandum from J.J. Keenan, CPSC, *Summary Review of Urea-Formaldehyde Foam Insulation Testing at Franklin Institute Research Laboratory, Oak Ridge National Laboratory and CPSC's Engineering Laboratory*, October 23, 1981.

Economic Information

EC-11 *Report on a Survey of Insulation Contractors*, CPSC, October 1981.

EC-12 *Summary of the Survey of Insulation Contractors*, Charles Smith, CPSC, October 9, 1981.

EC-13 Report by Charles Smith, CPSC, *Urea-Formaldehyde Foam Insulation—Revised Preliminary Economic Assessment of a Ban of Sales*, November 1981.

EC-14 Memorandum by Charles Smith, CPSC, concerning telephone conversation with National Insulation Certification Institute, dated September 22, 1981.

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